A CASE STUDY ON CONTAINERIZATION FOR A PULP MILL IN NORTHERN BC

by

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Glossary

3P
Public Private Partnership. Is a venture funded and operated though a partnership of government and private industry.

Billet
A pallet like platform used to lift breakbulk cargo in and out of a ship's hold.

Breakbulk Cargo
General cargo that is handled piece by piece in a ships hold, not containerized or intermodal.

FEU
A 40-foot ISO container, measuring (nominally 40 feet by 8 feet by 8 ½ feet. (Forty-Foot Equivalent Unit)

Gondola Car
A rail car specially designed to haul double-stacked shipping containers, with the bottom of the body of the rail car below the top of car wheels, to reduce the overall height of the container cargo. Also called a well car.

Just In Time
A strategy for inventory management in which raw materials and components are delivered from the vendor or supplier immediately before they are needed in the manufacturing process.

Kraft Pulp
Kraft pulp is what you get after you place a chip of wood in a pressurized vessel in the presence of hot caustic soda and sodium sulfide. The cooking process attacks and eventually dissolves the phenolic material called lignin that glues the fibers to each other in the wood. The word "kraft" means "strong" in the German language of its origin

NBSK
Northern Bleached Softwood Kraft pulp. Standard of pulp that is made from coniferous trees growing north of the 45th parallel in North America, Europe and Asia.

Pallet
A flat transport structure designed to hold freight items, to allow for easy handling by forklifts and reduce damage to the item.

Post Panamax Vessel
A ship that is too large to fit through the Panama Canal

Shipping Company
A steam ship or container ship line that hauls cargo by ocean.

TEU
A 20 foot ISO container, measuring (nominally) 20 feet by 8 feet by 8 ½ feet. (Twenty-Foot Equivalent Unit)

Unitized Pulp
A package of 8 bales of pulp, weighing approximately 1800 kg, held together with wire, used to handle breakbulk pulp

Well Car
A rail car specially designed to haul double stacked shipping containers, with the bottom of the body of the rail car below the top of car wheels, to reduce the overall height of the container cargo. Also called a Gondola car.

Van
A 53' dry trailer, pulled by truck for hauling cargo.

1.0 EXECUTIVE SUMMARY

This document examines the state of containerization in Northern British Columbia, specifically at Mackenzie Pulp Mill Corporation, describing the current situation and examining the opportunities that containerization could bring the mill and industry in the Central Interior.

Containerization has revolutionized cargo transportation and has reduced the cost, time, and damage of every product shipped by container.

In September 2007, Prince Rupert opened a state of the art, 500,000 TEU container port facility. A 3P partnership that incorporates the latest technology and container management systems, along with the largest cranes on the West Coast, able to service the newest super post-Panamax vessels up to 12,500 TEU. CN rail upgraded its rail lines from the port to Chicago and Memphis, to allow seamless double tracked container transport on the least congested rail line in North America. CN also built two inland container terminals, one in Prince George and the second in Edmonton.

Despite the proximity to this transportation infrastructure, and 30% to 40% of the containers returning to Prince Rupert empty, industrial users such as Mackenzie Pulp still rail their pulp in conventional boxcars to Vancouver for stuffing into containers for shipping to Asia.

The reasons for the lack of container use are complex, but the outcome is maintaining the status quo is the least expensive method of delivering

product to their customers and it will take further developments before industry will be able to load containers in the North.

2.0 INTRODUCTION

Containerization has transformed the way products are moved around the globe, and has been called the 3rd industrial revolution (Stulman 1974), owing to the way that it has transformed society. Despite the impact that containers have had, there has been very little serious study of the container and its consequences, except in the area of labour relations (Levinson 2008). The purpose of this document is to examine the current use of containers in Northern British Columbia using Mackenzie Pulp Mill Corporation's experience, and then to investigate alternatives to circumvent the current impasse of no containers being filled by industry in the Northern Interior of British Columbia and take advantage of containerization for transportation of pulp to Asia.

The document surveys the history of containerization, detailing the physical and financial reasons for the success of containerization throughout the world and extrapolates the benefits of containerization to the pulp mill's current shipping practices. The document describes the current situation regarding the shipment of pulp and assesses the opportunities that containerized shipping from the mill site might provide.

The document then offers suggestions on how current practices could be changed to allow industry in Northern British Columbia and Mackenzie

Pulp Mill specifically to take advantage of the benefits of shipping in containers.

3.0 LITERATURE REVIEW

This literature review will survey the literature describing how containerization works, starting with an examination of the history of breakbulk cargo, containers and ports. It will then look at the economics of containerization and the railroads role in moving containers.

3.1 Breakbulk Cargo

The history of containerization first starts with the history of shipping. Before containerization, shipping a product had not changed since the time of the Phoenicians (Donovan 2004). Manufacturing was typically an urban enterprise, with factories clustered near the docks for ease of delivery of raw materials and faster shipment of finished goods (Levinson 2008). The shipper would load his goods piece by piece, all tagged for its destination, into a truck, rail car or cart for delivery to a warehouse called a transit shed along side the dock. Each piece was unloaded, tallied and stored in the transit shed. When the ship was ready to load, each item was removed from the transit shed, tallied, and placed beside the ship. Longshoremen would gather the cargo into a draft, which is basically a pallet, often sitting on a net. Cables would be positioned underneath the pallet and it would be hoisted into the ships hold. Here the skilled longshoremen would pack the cargo into the hold of the ship, assembling the cargo so that they maximized the space inside the ship and ensured that everything was packed tightly, so that nothing could shift or

break during the voyage, endangering the ship or the other cargo (Talley 2000).

At the destination port, the procedure was reversed, with the longshoremen picking through the jigsaw puzzle of the tightly packed cargo, carrying each piece to a draft to be hoisted out of the hold. The cargo was then spread out on the dock, to be inspected by customs, and then the buyer's representatives. After duties were assessed and the goods were pronounced to be undamaged, the tags were read, tallied and the products were sorted to the transit shed. Here pieces were loaded on to a truck or train for delivery to their next destination.

The process was slow and expensive. The ship could not start to be loaded until all the cargo was unloaded. The average time that a cargo ship spent in port was three weeks, which made for a very nice life for merchant seamen and itinerant travellers, who could enjoy the time in a port (Updegrove 2006). However for the owner of the ship this was very expensive, with 60 to 75% of the cost of transporting cargo by ship being spent on the dock. (Levinson 2008).

The high cost of shipping was a disincentive to ship products overseas, so the world was full of small manufacturers shipping locally.

The cost of freight to sell internationally could be 25% of the cost of the item. In the United States, international trade was a smaller percentage of the economy in 1960 than it was in 1950 or even in the depression year of 1930, because of the increasing cost of international freight. (Levinson 2008)

3.2 Containers

Breakbulk cargo was subject to theft from the dockworkers. In New York, it was estimated that 30% of the whisky and coffee travelling through the port disappeared through shrinkage (Donovan 2004). In an effort to control theft, reduce handling, and improve efficiencies, various shippers tried shipping their products in boxes. The French and English railways tried wooden containers to move household furniture in the late nineteenth century, using cranes to move the boxes from flatcars to horse carts. In 1929, an American steamship operator, Seatrain Lines, operated specially built ships holding railway boxcars in metal cells, lifting the cars on and off the ship with dockside cranes. In 1949, Brown Industries of Spokane, Washington built 30-foot aluminum boxes that could be stacked two high on barges operating between Seattle and Alaska, or placed on a chassis and pulled by a truck. (Levinson 2008). None of these containers were very successful, however, and the shippers of the world struggled with expensive, slow deliveries and shrinkage of high value products.

This started to change in 1955, when the owner of a trucking company, Malcom McLean, realized that most shippers of cargo didn't care how a product got to its destination; they just wanted it to get there (Postrel 2006). The ICC (Interstate Commerce Commission) controlled the shipping and pricing of all shipping routes in the US and wouldn't let a trucking company own a shipping company. McLean sold his trucking company and purchased a US shipping company, Pan-Atlantic Steamship corporation, which in 1955,

operated 4 ships and had operating rights to 16 US east coast ports. Four months later, he purchased Pan-Atlantic's parent company, Waterman Steamship Corporation.

McLean's plan was to build 7 new, roll-on/roll-off ships that could carry 288 truck trailers each, but through his planning McLean realized that this would be inefficient; the wheels beneath each trailer would waste a lot of space. Without wheels he could gain a third more usable cargo space. Without the wheels, however, there was no way to load and unload these trailers, the trailers were not strong enough to be lifted and could not support other trailers for stacking. McLean abandoned the building of the roll-on/roll-off ships and then decided instead to purchase some ex WW2 oil tankers and convert the decks to hold containers. After experimenting with strengthening road trailers, McLean instead decided to purchase two hundred, 33-foot containers from Brown Industries who were building and using 30-foot containers on their Seattle to Alaska route. McLean then hired Brown's chief engineer Keith Tantlinger to figure out how to make the containers stackable and secure. Tantlinger was successful in devising a corner clamp that would support the container when being lifted and allow the container to be locked to the containers below and above to secure the container during heavy seas. With his engineering problems solved, McLean had to wait for both the ICC and the Coast Guard to approve his plan. On April 26, 1956 he loaded 58 containers on his ship, the Ideal-X, in under 8 hours and transported them from Newark New Jersey to Houston Texas for a loading cost of $0.158 per ton,

compared to a breakbulk rate of $5.83 per tonne (Levinson 2008). Malcolm faced huge opposition from trucking companies, railroads and longshoremen, all of who, at some point, refused to handle his containers and tried to disrupt his shipping business, in order to protect their jobs and businesses. While they caused him considerable grief along the way, they were ultimately unsuccessful in stopping his container business.

On the Pacific Coast, Matson Navigation Company started shipping 24-foot, 8 ½ foot wide containers from San Francisco to Hawaii on August 31, 1958 on a ship with 20 containers on its deck. In May 1960, Matson began sailing ships that held 408 - 25 ton containers, including 72 refrigerated units, all loaded and unloaded by purpose-built dock cranes capable of moving 400 tons per hour, more than 40 times the 10 tons per hour a longshoremen gang could move (Levinson 2008). Matson's cranes unloaded and loaded ships at the same time, by emptying one stack of containers then refilling the empty space, utilizing the crane in both directions.

The next step in containerization was standardization in container size, attachments and capacity. The United States Maritime Administration started working on this in 1958, followed by the American Standards Association and they decided by the summer of 1959 that the standard container would be 20 or 40 feet long, 8 feet wide and 8 feet high. There was no company in the United States using containers of that size, and it was a difficult process to get industry to agree to those sizes. In 1961 the Maritime Administration announced that 10', 20', 30' and 40' containers with 8'x8' width and height

were standard size containers. The International Standards Organization (ISO) then became involved and started working on getting an international standard for shipping containers. It took until 1970 for ISO to publish the worldwide standards sizes for containers.

ISO STANDARD CONTAINER SPECIFICATIONS

ISO Container Capacity			
Length	Cubic Capacity	Tare Weight	Max Gross Weight
20 feet	1165 cubic feet	5050 lbs.	67,200 lbs.
40 feet	2350 cubic feet	8000 lbs.	71,650 lbs.
40 ft HC	2694 cubic feet	8775 lbs.	71,650 lbs.

Figure 1

ISO Container Dimension - Exterior			
Length	Exterior Length	Exterior Width	Exterior Height
20 feet	19' 10"	8'	8' 6"
40 feet	40'	8'	8' 6"
40 ft. HC	40'	8'	9' 6"

Figure 2

ISO Container Dimensions - Interior			
Length	Interior Length	Interior Width	Interior Height
20 feet	19' 3"	7' 8"	7' 9.875"
40 feet	39' 5"	7' 8"	7' 9.875"
40 ft HC	39' 5"	7' 8"	8' 10"

Figure 3

ISO Container Dimensions - Door Opening		
Length	Width	Height
20 feet	7' 8"	7' 5"
40 feet	7' 8"	7' 5"
40 ft HC	7' 8"	7' 5"

Figure 4

(W&K Container n.d.)

3.3 Economics of Containers

As Malcom McLean had envisioned, shippers only cared about the delivered cost of their products. They didn't care about loading efficiencies. However in the 1950's in the United States, the ICC (Interstate Commerce Commission) regulated the rates and routes of trains and trucks with a mandate to preserve essential transportation services, prevent destructive competition and to promote efficiency and modernization (Donovan 2004) . The ICC introduced the Transportation Act of 1958, being directed by Congress not to keep any carrier's rates high just to protect another mode of transportation, but also to block unfair or destructive competition. The act allowed the railroads to competitively haul "piggyback" truck trailer loads, which was a semi trailer on a flat deck rail car. This was typically competitive on distances greater than 500 miles, which was the most a driver could travel in one day. Manufacturers were quick to learn that they could save money by filling trailers and shipping them by rail, which would prepare them for eventual container loading. Piggyback transportation generated new profits for the railroads and resulted in the railroads actively discouraging container movement by train, rationalizing that containers would reduce boxcar or piggyback traffic. European railroads, however, embraced the fledgling container market, offering flat rate transportation of containers as soon as they arrived in Europe (Levinson 2008). In the United States, this lack of rail

interest continued until the June 1970 bankruptcy of Penn Central, the largest railroad in the US, followed by 6 more rail bankruptcies. This required government intervention and highlighted the regulations that the ICC had in place that prevented the railroads and the trucking companies from being exposed to free market competition. In 1980 Congress removed the rules on interstate trucking, removed ICC from approving rail rates, and removed the rule that all rail customers should pay the same rates. By 1988 US shippers were paying almost 20% less for domestic freight. Where it had cost 4 cents to move 1 ton of containerized freight in 1982, rates dropped by 40% (before inflation) by 1988. The next step was the US Shipping Act of 1984 for maritime shippers, which allowed shippers and carriers to negotiate rates. The US Military's rate for containerized cargo in October 1979 went from $40.94 per 40 cubic feet either way across the Pacific to $2.30 Westbound and $15.89 Eastbound by 1986. This price reduction was on top of an inflation rate of about 30% during the same time period (Levinson 2008), which was an inflation adjusted decrease of $44.13 or 83%.

Today there are more than 77 container shipping companies, with a capacity of 13,108,589 TEU carried on 6,048 ships in the worldwide container business. The largest company APM Maersk has a capacity of 2,031 886 TEU, with 539 ships, and 15.5% of the market (Konrad 2009).

3.4 The Ports

As containerization reduced the cost of transportation to 1 to 2% of the cost of the goods (Donovan 2004), most of the initial savings came from the ports. Since 1960 the number of longshoremen employed declined by 95% (Donovan 2004) as containers and cranes removed the need for the longshoremen to directly handle the cargo. Containers were stuffed and emptied away from the port, again removing the need for longshoremen. One benefit of these changes was that longshoremen were now working scheduled hours and no longer needed to be at the pier in the morning to hope for work, so they moved to the suburbs, away from the waterfront (Levinson 2008). With the workers moving away and manufacturing no longer required to be near the shipping point, the neighbourhoods surrounding the harbor became ghettos, resulting in unemployment and poverty rates significantly higher in port districts than the metropolitan areas that surround them. (Grobar 2008). Since port districts pay the social and political price for increased trade, without reaping any of the benefits , those living in the port districts have typically opposed any expansion of the port, and this has limited growth in trade (Grobar 2008). For governments in North America this is a continual political issue to be resolved.

As the rapid growth of containerization has devastated port workers, it

has also devastated some of the ports as well. When containerization arrived, if the port wasn't ready to handle containers, the shipping companies moved to ports that were. San Francisco's traffic moved to Oakland. London and Liverpool were England's biggest ports in the early 1960's, with half of the country's trade. The ports and the unions weren't ready to accept containerization, so the shipping companies moved to Felixstowe, a private port owned by the Felizstowe Railway and Dock Company, 90 miles north of London. By 1968 Felixstowe was England's largest container port, and London lost to Rotterdam its distinction as Europe's maritime center (Levinson 2008).

At this time, container ships are growing larger with each generation as operators exploit economies of scale (Cullinane and Khanna 1999). The container companies are embracing pendulum routes with a hub and spoke operation at each end (Medda and Carbonaro 2007). This model, similar to that of airlines, maximizes the ocean-going time of the largest containerships and minimizes port time. The issue for ports is that they need to have the depth, speed, handling costs, reliability and hinterland connections (Wiegmans, Van Der Hoest and Notteboom 2008) to handle these increasingly larger ships economically. The issue for policy makers is funding these capitally expensive ventures without any guarantee that the shipping lines will come. The ports have become pawns in the global transportation industry

(Talley 2000), with shipping companies moving on a whim to the next location that has less overall cost. To accommodate increasingly larger ships or just to keep up with the competition, ports must constantly invest large sums of capital, with no guarantee that the shippers won't move to the next port that offers them a better deal. One solution that is growing in popularity is leasing the ports to private operators. The operators who lease the terminals and pay for port equipment often have better access to capital and can spread the cost over many operations. They also don't overinvest in the hopes of spurring local development (Postrel 2006). Prince Rupert's Fairview Terminal is an example of a private operator investing capital to operate a container port (Western Economic Diversification 2007).

3.5 Railroads and Power

Railroads in North America have had a long history of resisting change in order to preserve the status quo. In 1966 Malcolm McLean wanted his sales people to find manufacturers in the Midwest who were exporting to Europe and have them consolidate their products in containers that McLean would truck in to freight yards in Chicago and St Louis. There, they would be double stacked on rail cars that McLean would purchase for special trains that would transport the containers to McLean's dock in New Jersey. Shipper's costs for the domestic portion of the trip to Europe would fall by half, and customers

would know when their product would arrive. The railroads responded with the minimum offer that the ICC would allow: they would take the containers but they would be mixed in with other cars on their regular slow freight trains.

In 1967 Whirlpool Corporation asked New York Central Railroad to move containers of refrigerators to New Jersey. The railroad responded by telling Whirlpool to ship them in boxcars and stuff them into containers at the port. Whirlpool containerized them and shipped them by truck (all from Levinson, 2008).

While most railroads now haul containers, the railroads are still unfriendly to container companies. In her 2003 study, Lopez reported that unlike trucking companies, railroads won't haul empty containers on a spot basis; the empty containers need to be part of a minimum one year contract. This contract is for a specific capacity, based on the previous years movements. If a shipper has a record of increasing volume every year, then the railroad will increase the capacity in the new contract. The shipper pays for capacity even if they don't use it. If a shipper uses more capacity than booked, they pay a premium for the extra capacity. Because the railroad has a monopoly, they don't need to negotiate, but will dictate to the shipper what the terms will be (Lopez 2003).

As container traffic grows, railroads will become increasingly

dependent on container traffic for their profits. This dependancy should allow the container companies to exert more influence over the railroads concerning freight rates and transit times.

4.0 BACKGROUND

Before containerization, a manufacturer would produce its product, tag it for the destination and then would pay to have it shipped by truck, rail or cart to a warehouse at the port. After unloading at the warehouse, the quantity and destination would be recorded and it would be stored in the warehouse. When the ship was ready to load, the products would be moved to the dock, tallied again, and placed on billets (basically a pallet, often sitting on a net) and hoisted into the ship. The billets would then be unloaded into the hold. While forklifts would be used on larger items on bigger ships, raw muscle by the longshoremen was used extensively. The hold needed to be packed tightly, both to maximize space, but primarily to ensure that no cargo would shift while at sea, which could damage other cargo or even jeopardize the ship. On arrival at the destination port, the procedure would be reversed, with billets lowered into the hold of the ship, and the goods loaded onto them and then winched out to be placed on the pier. Inspections would take place, both for customs and by the owner's representatives to check for damage. The product would then be put into the warehouse. This labour intensive process of loading and unloading the ships could take days or weeks, depending on the size of the ship and the productivity of the longshoremen.

Depending on the volume, the product could be shipped directly to the customer, or the product would be consolidated for shipment by truck or train to a regional warehouse, where it would be unloaded and then reloaded onto a truck for final delivery to the customer.

This was an expensive process, with each handling of the product taking time and creating an opportunity for theft and damage, which for high value products (like alcohol) could be 30% of the product.[1] As well, each time the product was put into a warehouse, it could spend days to weeks sitting, waiting for the next leg of the journey. The producer of the product would need to arrange for the shipment to the port, the shipment across the ocean, the customs at the port, delivery to the regional warehouse and the final delivery to the purchaser, which could involve five different weigh bills. The producer would be responsible for payments for shipping to five different companies, plus custom brokerage and duty, often all in advance.

4.1 Shipment of Pulp

Because of the volume of pulp shipped, manufacturers have devised ways to make the transportation of pulp more efficient than traditional breakbulk. When pulp is produced it comes out of a dryer in a wide continuous layer. The layer is slit into sections and the sections are cut into sheets. The sheets are then stacked into bales. Each bale of pulp weighs about 200 kg.

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[1] (Donovan 2004)

Pulp on the bale scale at Mackenzie Pulp. The weight is in kilos, the bale of pulp has not been be compressed at this point.

Figure 5

Photo by Mark Robillard

The bales are compressed to reduce volume for shipping and then wrapped with a sheet of pulp. Zinc-covered carbon steel wire is used to hold the bale together.

Figure 6

Photo by Mark Robillard

The bales are then stacked 4 high and two stacks are wired together in a unit.

This unitized pulp is transported to a port for breakbulk or container loading.

Figure 14

Photo by Mark Robillard

At the port, special lifting mechanisms are used to lift multiple units of pulp into the hold of a breakbulk ship. This process has increased the efficiency of loading breakbulk pulp.

Figure 8

Photo by Dick Lund.

http://dlund.20m.com/ZMarMen01.html

The breakbulk pulp is loaded tightly into the hold of a ship for transportation. As with all breakbulk it is important to ensure that the cargo does not shift or move during the sea voyage.

Figure 9

Photo from UK P&I Club

http://www.ukpandi.com/loss-prevention/cargo-stowage-advice/cargo-photo-library/general-cargo/wood-pulp-bales/

Unitized breakbulk pulp is typically sent to Europe. Most Asian paper mills receive their pulp in containers. The typical mill in the Central Interior unitizes their pulp and sends it to Vancouver in a boxcar where it is either stuffed into a container or loaded breakbulk.

5.0 PROBLEM AND OBJECTIVE

Mackenzie Pulp is a small kraft pulp mill, producing about 240,000 tonnes of pulp per year. The Mackenzie mill historically shipped most of its pulp production by rail to the North American paper and tissue market. As Latin American and Asian paper makers built newer, faster and bigger paper and tissue machines over the past two decades, they have put pressure on North American paper and tissue makers to become more efficient. The North American industry was not entirely successful in its ability to respond to the pressure, and paper and tissue mills began to close in response to these less expensive imports.

As a result, Mackenzie Pulp had to find other customers for its pulp, and gradually shipped more product to Asia and Europe. At the time of the mill closing in 2008, the mill shipped 40% of its product to Asia, 40% to North America and the remaining 20% to Europe.

In 2010 Paper Excellence BV, a wholly owned subsidiary of APP, Asia Pulp and Paper, purchased Mackenzie Pulp out of bankruptcy. Privately held APP is the third largest pulp and paper company in the word, with a stated goal of becoming the world's largest pulp and paper company. APP is part of a larger family-held company called Sinarmas, based in Indonesia, with interests in industrial agriculture, banking, insurance, education, mining and manufacturing.

Mackenzie pulp was purchased specifically to provide its very high quality NBSK (northern bleached softwood kraft) as raw material to APP's

paper and tissue machines in Asia. All of Mackenzie Pulp's production is sent to Asia.

The pulp is loaded into CN boxcars and railed to Vancouver, where it is unloaded, put into a warehouse, and then reloaded into containers for shipment to Asia. The efficiency of this process could be improved by looking at the feasibility of loading pulp into containers in Mackenzie for shipment to Asia.

Current process of shipping pulp at Mackenzie Pulp

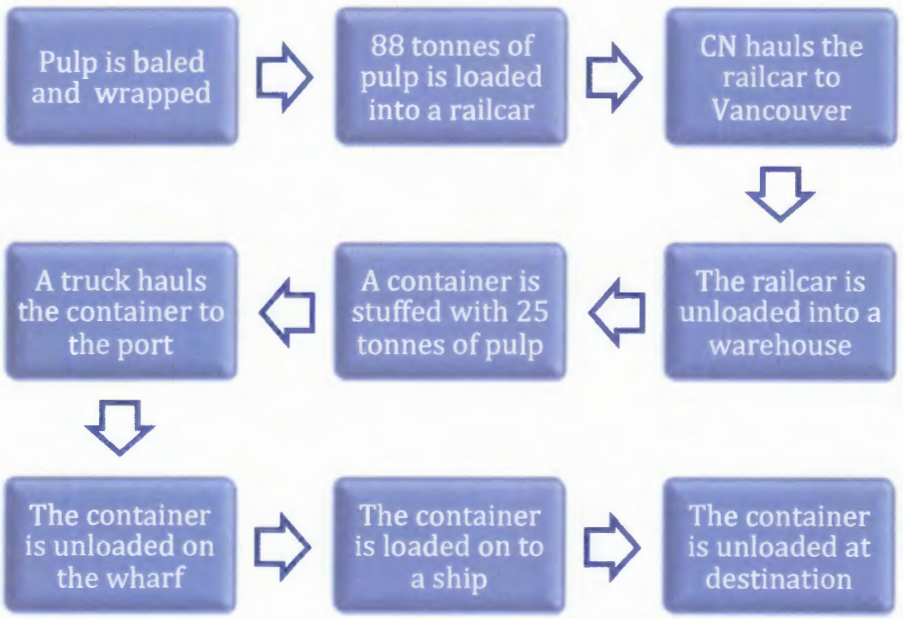

Figure 10

Proposed process for shipping pulp from Mackenzie Pulp

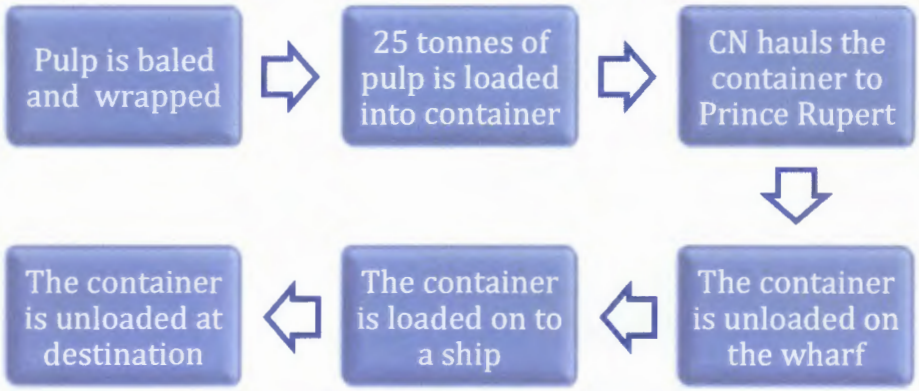

Figure 11

Boxcars are rectangular shaped rail cars, with double doors on each side, which hold about 88 tonnes of pulp. Pulp mills prefer vented rail cars, which are cars with air vents located on the topsides of the cars that increase the airflow through the car. Without side vents, condensation from moisture evaporating off warm pulp collects on the roof of the railcar and drips back onto the pulp in cold weather. The pulp absorbs this water and expands. This expansion destroys the integrity of the bale of pulp and increases the difficulty for the customer to unload the pulp. CN currently provides about 40% of the supplied cars as vented cars.

CN Boxcar

Figure 12
http://www.flickr.com/photos/86812298@N00/493317763
by Kumar McMillan

Containers come in a variety of standard sizes and include vented boxes for pulp. The two most common sizes in North America are:

Standard 20 foot ISO Container							
Inside length	Inside width	Inside height	Door width	Door height	Capacity	Tare weight	Maximum weight
19' 4"	7' 8"	7' 10"	7' 8"	7' 6"	1172 ft³	5071 lb.	67,197 lb.
5.9 M	2.35M	2.393M	2.342M	2.28M	33.2M³	2300 kg	30,480kg

Figure 13

Standard 40 foot ISO Container							
Inside length	Inside width	Inside height	Door width	Door height	Capacity	Tare weight	Maximum cargo
39' 5"	7' 8"	7' 10"	7' 8"	7' 6"	2390 ft³	8,267 lb.	71,650 lb.
12.036M	2.35M	2.393M	2.342M	2.28M	33.2M³	3750 kg	32,500 kg

Figure 14
[2]

[2] (Ahn n.d.)

20-foot sea container – 1 TEU

Figure 15
Photo from Outspan.us
http://www.mcssl.com/store/1895384/catalog/product/7d1ced56c9ee4a279ecaf423d7309108

The 40-foot containers are gaining in popularity with shippers, as they require half of the ship loading time of a 20-foot container. However with heavy commodities such as pulp, 20-foot containers are used, as the maximum payload of a 20-foot container is 28,180 kg and the maximum payload of a 40-foot container is 28,750 kg and a 20-foot container reaches its maximum weight before it fills its volume.[3]

CN has a monopoly on all rail movement in the Northern Interior of British Columbia; moving pulp by boxcars or in containers by rail has to be done by CN. CN does not own any containers and currently its fleet of double gondola cars is only allocated for East-West Traffic, specifically between

[3] (Ahn n.d.)

Prince Rupert or Vancouver and Eastern Canada or the Chicago Memphis area of the United States.

Gondola car hauling double stacked 53-foot containers

Figure 16
Photo Sean Lamb
http://commons.wikimedia.org/wiki/User:Slambo/Gallery

Containerization has changed the shipping and logistics world, allowing worldwide commerce to develop and flourish.[4] It has decoupled the need for an exporter to be near a port to reduce freight costs.[5]

When a container is ordered, the shipping company can give a delivery date describing when the container will be delivered. The shipping company

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[4] (Gooley 1997)
[5] (Postrel 2006)

looks after all of the freight and logistics. The container's contents, bills of lading and customs paperwork are all tracked electronically, allowing shippers to know the location of the container at any moment in time. Typically customs clearance is done before the ship arrives at port, allowing for more rapid movement away from the port.[6]

Shipping companies arrange for the shipping of containers with the railroads.[7] Because of shipping companies' railcar volumes, they can purchase transport less expensively than an individual shipper such as a pulp mill, or even a group of pulp mills. The shipping companies prefer secure long-term transport arrangements, to reduce the risk of disruption of container movement.[8]

In 1956 before containerization, loose cargo cost $5.86[9] per ton to load. Using an ISO container, this cost was reduced to 16¢ per ton for loading. The total cost of containerized shipping including ground shipping, loading, unloading and the ocean voyage typically costs 1% to 2% of the retail cost of the product, 90% less than before containerization using breakbulk.[10]

With containerization, the manufacturers' product arrives at their customers in weeks, exactly as it left the factory.[11] Prior to containerization, the delivery would take months, and the multiple handling and storage would result in shrinkage and damage.

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[6] (Levinson 2008)
[7] (Lopez 2003)
[8] (IBED)
[9] (Levinson 2008)
[10] (Donovan 2004)
[11] (Talley 2000)

Containerization has changed the way the world does business. Containers have allowed Walmart to become the behemoth of retailing, by reducing delivery time, cost and shrinkage. The United States Military first started using containers during the Vietnam War [12] and containers have been an essential component of mobilization and supply since then. On a personal level, containers have allowed North American consumers to have 4 times the product choice they had in the 70's and, for example, allow you to buy beer or wine from anywhere in the world at your local liquor store with the transportation portion of the cost only a few cents per bottle.[13]

Containerization has taken billions of dollars of inventory out of the supply chain and the rapid, traceable and predictable delivery has allowed just in time manufacturing to flourish. Toyota's manufacturing plant in Kentucky, for example, uses just in time inventory management to build cars in an area hundreds of miles from other car manufacturing and suppliers.

Containerization has changed the economics of ports through three different aspects. The container movement business is highly competitive, with shipping lines moving quickly to utilize the most efficient and least expensive ports and carriers. Thus a city like Everett, Washington, which lost its major container carrier, is now an underutilized port, looking for new customers.[14]

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[12] (Levinson 2008)
[13] (Donovan 2004)
[14] (Gillie 2010)

The second result of containerization is that port cities, which used to be hubs of commercial activity, supported by the loading and unloading of break bulk cargo, and surrounded by manufacturing and warehouses, are now in commercial decline, as containers and their cargo quickly and safely leave and arrive at the ports on the way to and from the final destination. Up to 95% of the longshoremen jobs have disappeared in ports that have shifted from bulk cargo to container, creating economic ghettos in the areas surrounding the docks.[15]

The third change is that proximity to a port is less important than at any time in history. The need to be located near a port has been eliminated, leading to regional socio-economic growth. Shipping costs have declined, so other pure economic issues determine the location of producers.[16] Ports have now become just another link in a flexible supply chain[17], where every link is continually monitored for cost and efficiency and the weak link replaced as required.

The Canadian and British Columbia governments, along with the autonomous Prince Rupert Port Authority, privately owned Maher Terminals and CN Rail have developed a container port facility in Prince Rupert. Opened on Sept 12, 2007 the state of the art terminal boasts some of the largest cranes on the West Coast to service the newest super Post-Panamax vessels that can carry up to 12,500 TEUs (20 foot equivalent units). The port can currently

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[15] (Grobar 2008)
[16] (Slack 1993)
[17] (Donovan 2004)

handle 500,000 TEUs per year with plans in place to increase the capacity to 2 million TEUs per year. CN rail double tracked portions of their rail line and increased the length of the sidings from Prince Rupert to Memphis, enlarging all their tunnels and bridges to allow double stacked containers, to facilitate 4 million TEU capacity. CN worked with Maher Terminals on the design of the rail terminal to allow the most efficient movement of containers into and away from the port.[18]

The Prince Rupert port is the deepest natural harbor, with capacity to expand, on the west coast. The port is one day closer to Asia than Vancouver and Seattle and 3 days closer to Asia than Los Angeles.[19]

CN's rail line delivers rail containers to Chicago from Prince Rupert in 96 hours. The rail line is viewed as the fastest and least congested in North America. To support the container traffic, CN has built two inland container terminals, in Prince George and in Edmonton. As of March 2010, 30% to 40% of the containers returning to Prince Rupert contained cargo; the rest were empty.[20]

It is clear that the interior of British Columbia is set up to take advantage of containerization, with a new underutilized port, a state of the art railroad running past our operations, and empty containers returning to Prince Rupert.

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[18] (Western Economic Diversification 2007)
[19] (Western Economic Diversification 2007)
[20] (IBED)

However, there are no industries in the central interior that are taking advantage of containerization to any degree. The author's tour of CN's Prince George inland container terminal in August 2010 showed an empty warehouse, with no cargo in the warehouse to be loaded into containers. The operator of the warehouse said that Canfor was loading 6 containers of pulp per day and shipping the containers through Prince Rupert. This would represent about 120 tonnes of pulp, which is estimated to be less than 5% of their daily pulp production. The positive economic benefits of containerization are not being realized in the central interior.

It is less expensive for an interior mill to load its pulp into boxcars, send the box cars to Vancouver, have the box car unloaded into a warehouse, have the pulp loaded from the warehouse into the containers and then have the containers trucked to the dock for loading than it is for the mill to load a container and send the container to Prince Rupert.

There are three primary reasons for this paradox. The first is that because of competition from multiple container companies in Vancouver, it is less expensive for a shipper to load a container on a ship in Vancouver and have it travel to Prince Rupert and then on to Asia then it is to load the same container in Prince Rupert.

The second is because companies that are shipping into Prince Rupert have not been interested in releasing containers to pulp mills for shipping pulp

through Prince Rupert as this would delay the return of their empties to Asia.[21]

The third reason is that currently CN does not appear to want to disturb the status quo and allow gondola cars to travel on a North-South route. They would prefer to continue to move pulp to Vancouver in boxcars for container loading, collecting the freight charges from each shipper, rather than to haul containerized pulp to Prince Rupert and be paid by the shipping companies. It is the author's belief that industrial users pay a higher freight rate than container shipping companies.

The objective of this paper is to examine the current use of containers in Northern British Columbia using Mackenzie Pulp Mill Corporation's experience, and then to investigate alternatives to circumvent the current impasse of no containers being filled by industry in the Northern Interior of British Columbia and take advantage of containerization for transportation of pulp to Asia.

The data for this project was acquired from Mackenzie Pulp's internal financial data, bids for pulp movement from CN Rail and CN Worldwide, bids and quotes for movement of pulp from container steamship lines and from other industry sources, both inside and outside of Paper Excellence.

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[21] (Ryan 2010)

6.0 ANALYSIS

As a general rule, trucking is less expensive than rail for hauls less than 500 km.[22] As a shipper, it is easy to calculate a trucker's actual costs by combining the wages, fuel, depreciation and profit margins, ensuring trucking companies' rates are easily auditable. In addition, trucking in North America is highly competitive, with low cost of entry and exit, resulting in bids for freight movement by truck from multiple companies being very competitive and very close in price. Rail, on the other hand, does not disclose its costs and at times will offer service below their stated tariff to compete with trucking on shorter hauls, if they decide they want the business.

Mackenzie Pulp Mill spends $34.07 per tonne to rail our pulp to Vancouver. In Vancouver it costs $18 per tonne to unload the railcar and stuff the container, and another $16 per tonne to truck the container from the warehouse to the port, so the total cost from Mackenzie to the port is $68.07 per tonne of pulp (data from Mackenzie Pulp financial statements).

If Mackenzie Pulp were able to rail containers to the port in Vancouver, the mill should save $34 per tonne, the cost of stuffing the container and transporting it to the port. However CN will not release gondola cars for North-South traffic. This leaves CN transporting containers to Prince Rupert as the only option.

China Ocean Shipping (Group) Company (Cosco) is the major shipping company in Prince Rupert. Cosco's container ships arrive in Prince Rupert,

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[22] (Levinson 2008)

are partially unloaded and they then travel south to Vancouver and then to Portland, before turning north again to load in Prince Rupert. Cosco's price for shipping pulp to Shanghai from Prince Rupert is $70.73 per tonne and from Vancouver it is $70 per tonne (data from Cosco bids for moving pulp). This results in a saving of 73 cents per tonne or $18.25 per container to ship from Vancouver instead of from Prince Rupert. This is in spite of the fact that Cosco will haul the containers from Vancouver to Prince Rupert, before it heads East to Asia.

Unfortunately CN can't give a price to an individual for shipping containers to Prince Rupert; the railroads deal directly with the shipping companies for container shipping. Obtaining a price for shipping from Prince George to Prince Rupert requires a quote from a shipping company. At the present time, the shipping companies are not interested in giving a quote for containers to Mackenzie, so the quote was from Prince George to Shanghai. The quote was $114.24 per tonne (from Cosco), which combined with the cost of freight to Prince George and stuffing the container was $6.70 to $12.17 more expensive than the current routing, depending on how the pulp was shipped from Mackenzie to CN's inland freight terminal in Prince George.

Shipping Pulp From Mackenzie to a Container Stuffing Facility

	Prince George by Van	Prince George by Container	Prince George by CN Boxcar	Vancouver by CN Boxcar
Mackenzie to:	$27.00	$25.25	$21.53	$34.07
Container Stuffing	$9.00		$9.00	$18.00
Container Transport to Port				$16.00

Figure 17

Container Transport to Port and Ocean Travel

Vancouver to Shanghai	$70.00
Prince Rupert to Shanghai	$70.73
Prince George to Shanghai	$114.24

Figure 18

Total Freight Cost for Pulp from Mackenzie To Shanghai Via:

Prince George by Van, Container Through to Prince Rupert By CN	Prince George by Truck Container, Through to Prince Rupert By CN	Prince George by CN Boxcar, Container Through to Prince Rupert	Vancouver by Boxcar, Container Trucked to Port in Vancouver
$150.24	$139.49	$144.77	$138.07

Figure 19

All freight amounts given are from the summer of 2010. Shipping rates change on a constant basis depending on volume, competition, the state of the economy, the price of oil, and a host of other smaller variables. While the freight numbers are out of date, the differences between competing rates will remain the same, allowing for a reliable comparison of the options.

Canfor is currently shipping 6 containers per day out of Prince George to Prince Rupert. This is less than 5% of their production, which would lead to the inference that they have not found a better freight solution than Mackenzie Pulp has and are loading containers as a risk mitigation strategy.

7.0 CONCLUSION

Despite the examples in the literature of companies saving large amounts of money and time using containers, this opportunity has not presented itself in Northern British Columbia. The primary reasons for this are that CN will not allocate any container carriers to any routes other than the East – West Prince Rupert to Chicago haul (personal conversation with a CN sales representative, April 2010),1 and the shipping companies do not want to trouble themselves with the issue of delivering empty containers to any site off the East-West mainline. "Many Canadian export products require extended free detention time at destination – in some cases up to 21 Days. From a carrier's perspective, it is better to forgo the export revenue if your equipment will be tied up for extended periods in the market where you need the empties the most. Better to ship empty and supply the containers to the export demand in China".[23]

There are a number of opportunities that would allow Mackenzie Pulp to access containers and the ability to ship though Prince Rupert.

The first way to accomplish this would be to leverage APP's global volume of shipping. APP is the world's third largest pulp and paper company. They are part of the Sinarmas group of companies that include agribusiness, mining, insurance, banking and education. APP is investigating consolidating its shipping to one company. Currently APP sources bids for each of its shipments individually. If APP were to consolidate their shipping to one

[23] (Ryan 2010)

provider, the volume should ensure that individual mills like Mackenzie would be able to have a shipping company interested in serving them. This would obligate the shipping company to provide containers to the mill sites at a competitive rate. This is being worked on, but is not progressing with any rapidity.

The second opportunity to access containers and ship from Prince Rupert is to wait until more of the North American market realizes that the Port of Prince Rupert and CN rail service between Prince Rupert to Chicago is fast and uncongested and it will be more economical to ship along this faster route. This increased traffic will attract other container ship lines. This increased competition for the container traffic should lead to increased competition for a pulp and lumber backhaul to Asia and should provide the first opportunity to ship commodities from the Central Interior to Asia.

As the North American economy continues to rebound, the demand for products manufactured in Asia should increase the flow of containers from Asia to North America. Given the congestion in the West Coast ports of the United States this should mean that Prince Rupert will see more container traffic, which will increase the flow of empty containers past the mills in Northern BC, and provide access to containers.

Another scenario that could develop is that even if the traffic in Prince Rupert does not increase, the shipping lines could route more empties to be stored in Prince Rupert, to fill up the container ships returning to Asia on their last stop, to ensure that no paying cargo is displaced on earlier stops of the

ship. With enough of a buffer in Prince Rupert, returning empties could be made available to manufacturers in the North, allowing filled containers to progress through Prince Rupert.

The nine pulp mills in Northern British Columbia and the 6 pulp mills in Northern Alberta could form a consortium to consolidate their shipping to Asia. This could take advantage of the growing hub and spoke practice of the shipping companies, and there could be a single location in Asia where all North American pulp would ship to and then be distributed from. Given the competitive nature of the pulp industry, especially when pulp cycles through a low price cycle, continued cooperation would be difficult.

The growing demand for lumber in China, increasingly being supplied by Central Interior sawmills, could develop the container market for shipping lumber to China. The lumber by itself, or combined with the pulp shipments going to China, could be enough to attract a shipping company to make containers available to the interior.

The increasing population in the lower mainland of Vancouver could put increased pressure on CN becoming interested in hauling pulp through Prince Rupert rather than Vancouver. This could result from increased line congestion through Vancouver increasing the travel time through Vancouver and CN and it's customers looking to decrease the transit times. This disruption could force CN to make its northern line and the inland container terminal in Prince George more competitive as CN gives up on maintaining its boxcar traffic.

The second opportunity in this scenario would be political pressure from the residents of Vancouver to reduce pollution, noise and traffic congestion from both the trains and ships in the harbor. This pressure could influence the shipping lines and CN to divert more shipping to Prince Rupert. This would increase the pulp that move through Prince Rupert.

The last opportunity would be some other disruptive technology that would change the way that containerization works in Northern BC. The history of containers has been that no one has been able to predict what the next stage of containerization will be, or the direction that the market will take. It would not be unreasonable for some new development to change the way the business operates and make containers available for the Northern Interior.

8.0 RECOMMENDATIONS

It is inevitable that industry will have complete access to containers in the north. Throughout the history of containers there have been many attempts by self-serving groups to limit the access or growth in the movement of containers, but inexorably the most efficient way of doing business will win.

However Mackenzie Pulp should continue to pressure their parent company APP to develop a worldwide supply agreement with a single container company. This will give us first mover advantage in pulp shipments through Prince Rupert. When we start to move pulp through Prince Rupert, we should save, at a minimum, the difference of the costs of container stuffing and transportation to port in Vancouver, which is $25 per tonne or $5.87

million per year. In addition, there should be freight savings available from the container shipping companies' ability to purchase freight from CN better than the pulp mill can.

In the longer term as the traffic and competition increases in Prince Rupert, the rates from Prince Rupert to Asia should decrease to reflect the shorter sailing distance and time. Availability of containers should result in higher traffic, increasing the opportunity for industry in the Central Interior to affordably assess containers for their shipments to Asia.

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